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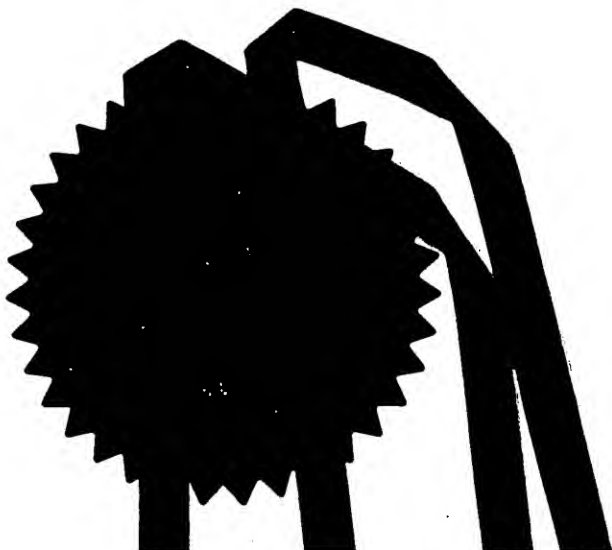


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Signed

Dated

20 March 2001

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Priority #2  
2-9-02

PATENT

3927 U.S. PTO  
10/025702  
12/19/01

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application Of: Andrew Arthur Hunter

Group No.: TBA

Serial No.: TBA

Docket No. 30005963-2

Filed: December 19, 2001

For: Tracking System

**CLAIM OF PRIORITY TO AND**  
**SUBMISSION OF CERTIFIED COPY OF UNITED KINGDOM APPLICATION**  
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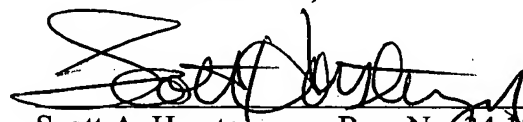
Sir:

In regard to the above-identified pending patent application and in accordance with 35 U.S.C. §119, Applicant hereby claims priority to and the benefit of the filing date of United Kingdom patent application entitled, "Tracking System", filed February 3, 2001, and assigned serial number 0102729.1. Further pursuant to 35 U.S.C. §119, enclosed is a certified copy of the United Kingdom patent application

Respectfully Submitted;

**THOMAS, KAYDEN, HORSTEMEYER  
& RISLEY, L.L.P.**

By:

  
Scott A. Horstemeyer, Reg. No. 34,183

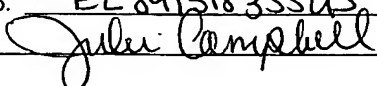
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EL 89158355145  


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05FEB01 E603139-1 001463  
P01/7700 0.00-0102729.1

# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road  
Newport  
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1. Your reference 30005963 GB

2. Patent application number (The Patent Office will fill in) 0102729.1 3 FEB 2001

3. Full name of each applicant (The Patent Office will fill in) Code of the or of (The Patent Office will fill in) Hewlett-Packard Company  
3000 Hanover Street  
Palo Alto  
CA 94304, USA

Patents ADP number (if you know it)

Delaware, USA

If the applicant is a corporate body, give the country/state of its incorporation

496588001

4. Title of the invention Tracking System

5. Name of your agent (if you have one) Richard A. Lawrence  
Hewlett-Packard Ltd, IP Section  
Filton Road  
Stoke Gifford  
Bristol BS34 8QZ

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Patents ADP number (if you know it)

7448038001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country	Priority application number (if you know it)	Date of filing (day / month / year)
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing (day / month / year)
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

a) any applicant named in part 3 is not an inventor, or

b) there is an inventor who is not named as an applicant, or

c) any named applicant is a corporate body.

See note (d))

Yes

# Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form

Description	6
Claim(s)	3
Abstract	1
Drawing(s)	1 + 16

10. If you are also filing any of the following, state how many against each item.

Priority documents	-
Translations of priority documents	-
Statement of inventorship and right to grant of a patent (Patents Form 7/77)	1
Request for preliminary examination and search (Patents Form 9/77)	1
Request for substantive examination (Patents Form 10/77)	-
Any other documents (please specify)	

## Fee Sheet

11. I/We request the grant of a patent on the basis of this application.

Signature Richard A. Lawrence Date 02/02/2001

12. Name and daytime telephone number of person to contact in the United Kingdom
- Meg Joyce Tel: 0117-312-9068

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## Notes

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- If you have answered 'Yes' Patents Form 7/77 will need to be filed.
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This invention relates to a tracking system and, in particular, to a system for tracking a moving subject.

It is known to provide, for example, a web camera to capture images which can be viewed remotely via a dedicated web page through the Internet. Thus, in one prior art system, several cameras are placed in, for example, a nursery and parents of children attending the nursery can view the images captured by the cameras via associated dedicated, secure web pages through the Internet.

However, when the subject of interest is moving, they may not always be within the view of the camera which is being accessed, in which case the user may need to access several web pages (using, for example, a web browser) thereby viewing the images captured by several cameras before the subject is located. Further, if the user wishes to follow the subject as it moves, they must guess which cameras to access in order to follow its progress.

We have now devised an arrangement which overcomes the problems outlined above.

In accordance with the present invention, there is provided a tracking system for receiving a plurality of cameras each at one of a plurality of locations within a predetermined area in which a movable subject or item of interest is located, each of said cameras being arranged to capture images of said respective location, the system comprising a single remote access point from which the images captured by said plurality of cameras can be viewed in real time or near-real time and/or recorded, locator means for determining a first location of said movable subject or item within said predetermined area selecting a first camera at said first location and linking the output of said selected camera to said remote access point, and for determining when said subject or item moves from said first location to a second location within said predetermined area, selecting a second camera at said second location and linking

the output of said second camera to said remote access point.

Thus, for example, a single dedicated web page could be used to access images of a moving subject of interest at any given time, irrespective of their location within the predetermined area at that time. The system continues to track the subject of interest and, as it moves from location to location, selectively links the output of the appropriate camera to the same remote access point, so that a single remote access point can be used to view images of a particular subject at any given time, irrespective of their location. It is significant that in the present invention, by switching links, a subject can be monitored without any user interaction, which provides substantial advantages over the prior art.

In general, in the present invention, a set of cameras is managed automatically such that a subject or item of interest can have a unique remote access point (as opposed to the access point being unique to a specific camera).

As the subject or item of interest moves out of the view of a first camera and into the view of a second camera, the view from the second camera replaces the view from the first camera at the remote access point.

Clearly, the images from the plurality of cameras could be subject to some deliberate or unavoidable time delay. Where relative delays are known, a person skilled in the art would appreciate that the apparatus of the present invention could be modified to enable a time-ordered sequence to be linked to the access point even though the actions of the subject may no longer be shown in real-time.

Examples of applications in which the present invention could be used would include watching a single schoolchild as he/she moves between classrooms, the school playground, the school bus, etc., watching a single sports competitor as he/she moves around a race track, watching a single car as it moves around the streets of a town (which would be particularly useful if the car had been stolen), and tracking a single



person or family group at a holiday destination, in order that an absent family member can share the holiday experience as it occurs, for example.

In one embodiment of the invention, when a specific  
5. remote access point is accessed, the system may be arranged to search for the item or subject associated with that remote access point and provide an image of that subject or item, and then track the subject or item as it moves around the predetermined area only while the remote access point is being  
10 accessed. Alternatively, however, the system continually tracks the subject or item and updates the camera output available at the remote access point, irrespective of whether or not it is actually being accessed.

The system preferably comprises a central database  
15 containing details of the various subjects of interest and their unique remote access point, the cameras and their respective locations.

Many different types of tracking means would be suitable for use in the present invention. For example,  
20 visually recognisable features could be tracked (such as a number plate on a vehicle, a distinguishing feature of a weather front, or a distinctive clothing or badge worn or carried by the item or subject of interest). Alternatively, several types of electronic tagging system are known. Any  
25 suitable type of tracking means may be used in the present invention and this patent specification is not intended to be limiting in this respect.

The apparatus of the present invention may provide for some interaction between the user (i.e. the person accessing  
30 the remote access point) and the camera. For example, if the subject or item of interest is at a location which is in the view of two or more cameras, the system may be arranged to provide two or more views at the remote access point for selection by the user if required. In another embodiment, the  
35 user may have the option to view a close-up from one of the

cameras or a longer view including more of the subject's surroundings. Other modifications of the original source images, such as cropping, sharpening or superimposing an indicator (such as an arrow) pointing to the subject within a  
5 view, may also be possible

The remote access point is preferably only accessible to authorised users by means of, for example, the entry of a code number or password. The apparatus may provide means for selectively recording the views fed to a remote access point.  
10 Further, the apparatus may include alarm means to alert the authorised user that the subject or item of interest has moved outside of the predetermined area.

The apparatus may be adapted so that the same remote access point can be used to track two or more subjects or items  
15 of interest.

There are two preferred ways in which the present invention may be implemented. In the first method, the apparatus comprises an attention controller which may be inserted between a plurality of cameras and one or more remote  
20 access points. The attention controller is configured to recognise specific items of interest and to associate each with its own remote access point (or URL). The controller tracks the items as they move between the cameras views and maps the resulting camera outputs to the appropriate remote access  
25 points (or web pages via the associated URL). The attention controller may be configured to continually track the subject(s) of interest and output the appropriate views, or it may be arranged to predict the next camera view to contain the subject as it moves, using knowledge of camera positions and/or  
30 subject motions, and map the predicted camera output to the remote access point. The attention controller may be implemented using several known methods of identifying items and tracking their motion.

In the second possible implementation of the present  
35 invention, the apparatus may comprise an attention controller

which is configured to monitor multiple camera views available, for example, via the Internet, identifying any items of interest in the views being monitored and map the outputs of the cameras to the respective remote access points associated  
5 with the items of interest identified.

It will be understood that all references herein to "cameras" is intended to encompass image capturing devices generally.

An embodiment of the present invention will now be  
10 described by way of example only and with reference to the accompanying drawing which is a schematic block diagram illustrating the basic manner of operation and functions of tracking systems according to an exemplary embodiment of the present invention.

15 Referring to Figure 1, an exemplary embodiment of a tracking system according to the present invention comprises first, second, third and fourth cameras 10, 12, 14 and 16 at first, second, third and fourth respective locations within a predetermined area. The outputs of said cameras 10, 12, 14,  
20 16 are connected to an attention controller 18.

The attention controller 18 monitors the outputs of said cameras 10,12,14,16 to locate the subject 20 of interest by identifying a visually recognisable feature in said camera outputs. If, for example, the attention controller 18  
25 determines that the subject 20 appears in the output from the first camera 10, it links the output from the first camera to a remote access point, say a dedicated web page, accessible through the Internet, so that the output from the first camera 10 can be viewed on a screen 22.

30 If the subject 20 then moves out of the view of the first camera 10 and into the view of the second camera 12, this is identified by the attention controller 18 which then breaks the link between the first camera 10 and the remote access point and instead links the output of the second camera 12 to  
35 the same remote access point. This process is repeated if the

subject 20 moves out of the view of the second camera 12 into the view of the third camera 14, and so on, so that a single remote access point can be used to track the movements of the subject 20 between a plurality of locations.

5           A specific embodiment of the present invention has been described above by way of example only, and it will be apparent to a person skilled in the art that modifications and variations can be made to the described embodiment without departing from the scope of the invention as defined by the  
10 appended claims.

Claims

- 1) A tracking system for receiving images from a plurality of cameras each at one of a plurality of locations within a predetermined area in which a movable subject or item is located, each of said cameras being arranged to capture images at said respective location, the system comprising a single remote access point from which the images captured by said plurality of cameras can be viewed in real time or near-real time and/or recorded, locator means for determining a first location of said movable subject or item within said predetermined area, selecting a first camera at said first location and linking the output of said first camera to said remote access point, and for determining when said subject or item moves from said first location to a second location within said predetermined area, selecting a second camera at said second location and linking the output of said second camera to said remote access point.
- 2) A tracking system according to claim 1, comprising a plurality of unique remote access points, each associated with a different movable subject or item.
- 3) A tracking system according to claim 2, wherein when a remote access point is accessed, the locator means is arranged to search the images being captured by said cameras to determine the location of the subject or item associated with said remote access point.
- 4) A tracking system according to claim 2, wherein said locator means is arranged to track the movable subjects or items and selectively link the outputs of the appropriate cameras to the respective remote access points, irrespective of whether or not said remote access points are being accessed.

- 5) A tracking system according to any one of the preceding claims, comprising a central database containing details of a plurality of subjects or items of interest together with their respective unique remote access points, and/or details of said cameras together with their respective locations.
- 6) A tracking system according to any one of the preceding claims, wherein said locator means is arranged to determine the location of a subject or item by identifying a visually recognisable feature thereof in the images captured by said cameras.
- 7) A tracking system according to any one of claims 1 to 5, wherein said subject or item of interest is provided with an electronic tag, and said locator means is arranged to determine the location of the subject or item of interest by determining the location of the electronic tag.
- 8) A tracking system according to any one of the preceding claims, wherein said locator means is arranged to determine the location of said subject or item of interest and, in the event that there are two or more cameras associated with said location, link the outputs of said two or more cameras to said remote access point.
- 9) A tracking system according to claim 8, comprising means for selecting to view one of said two or more outputs linked to said remote access point.
- 10) A tracking system according to any one of the preceding claims, comprising means for altering the field of view of the camera whose output is linked to said remote access point and/or comprising means to provide a link to a selected area of modified level of detail of the view.

- 11) A tracking system according to any one of the preceding claims, wherein said remote access point is accessible only to one or more authorised users.
- 12) A tracking system according to any one of the preceding  
5 claims, comprising means for selectively recording the camera output or outputs linked to a remote access point.
- 13) A tracking system according to any one of the preceding claims, comprising alarm means arranged to be actuated in the event that a subject or item of interest moves to a location  
10 outside said predetermined area.
- 14) A tracking system according to any one of the preceding claims, wherein a single remote access point can be used to track two or more subjects or items of interest.
- 15) A tracking system according to any one of the preceding  
15 claims, comprising an attention controller arranged to monitor the outputs of said plurality of cameras, determine the presence in said outputs of one or more subjects or items of interest and link the camera output or outputs in which said subject(s) or item(s) are present to the respective remote  
20 access point(s) associated with said subject(s) or item(s).
- 16) A tracking system substantially as herein described with reference to the accompanying drawings.

Abstract

A tracking system comprising a plurality of cameras (10,12,14,16) at each of a plurality of locations within a predetermined area in which a movable subject (20) may be located. The outputs of the cameras (10,12,14,16) are monitored by an attention controller (18) which identifies the presence of the subject (20) in the view of one of the cameras (10,12,14,16) and links the output of that camera to a single remote access point where an image of the subject (20) can be viewed on a screen (22). If the subject (20) moves out of the view of a first camera into the view of a second camera, this is identified by the attention controller (18), which then breaks the link between the remote access point and the first camera and instead links the output of the second camera to the remote access point. Thus, a moving subject can be tracked from location to location and viewed via a single remote access point.

Figure 1



1/1

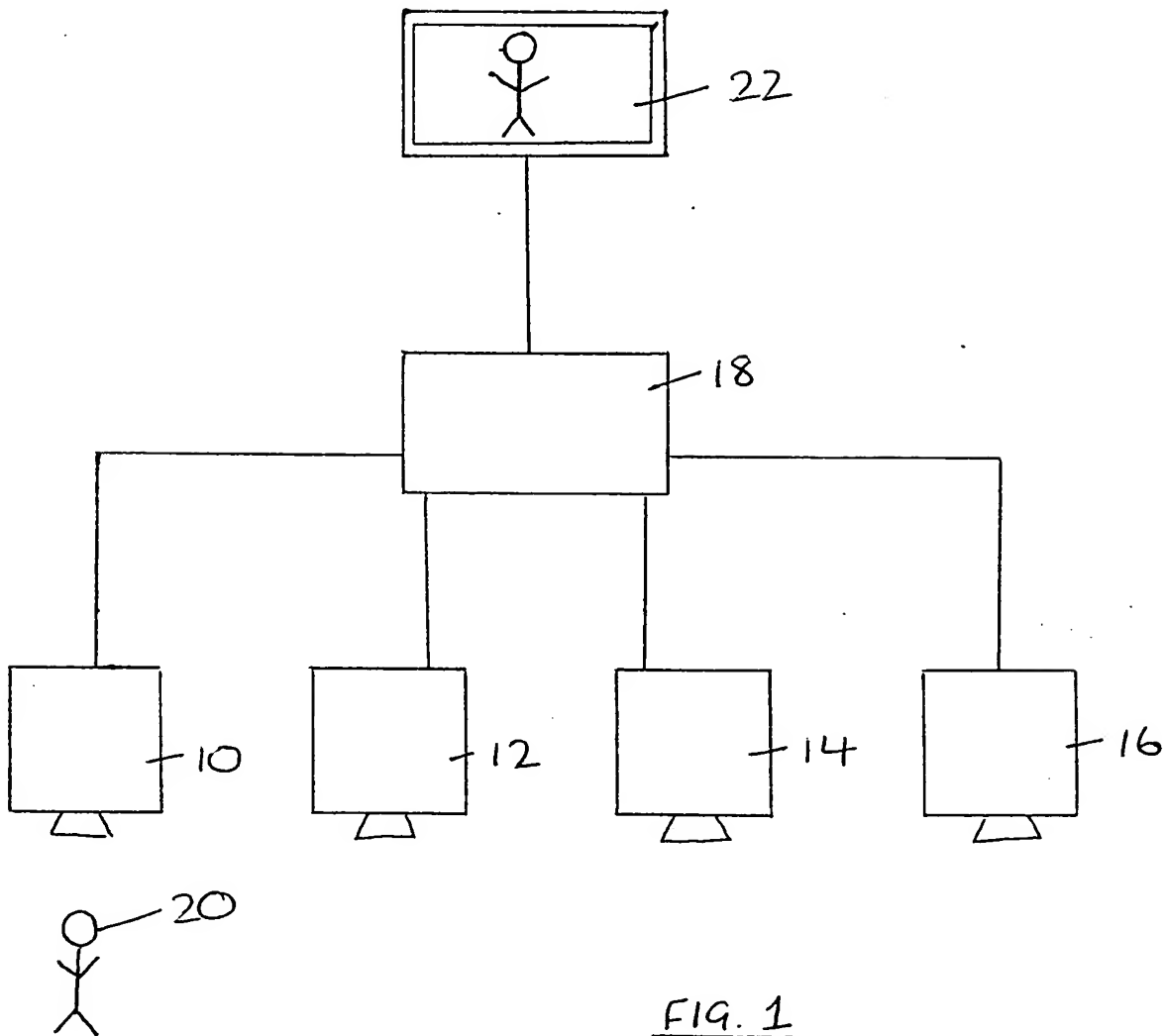


FIG. 1

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